61. Under what circumstances, if any, may an amateur station transmit radio communicatkms containing indecent words? [3AA-16.2]
A. Indecent words are permitted when they do not cause interference to any other radio communication or signal
B. Indecent words are permitted when they are not retransmitted through repeater or auxiliary stations
C. Indecent words are permitted, but there Is an unwritten rule among amateurs that they should not be used on the air
D. Indecent words are prohibited in Amateur Radio transmissions

62. Under what circumstances, if any, may an amateur station transmlt radii communicatii containing profane words? [3AA-16.3]
A. Profane words are permitted when they are not retransmitted through repeater or auxiliary stations
B. Profane words are permitted, but there is an unwritten rule among amateurs that they shouldnotbeusedontheair
C. Profane words 'are prohibited in Amateur Radio transmissions
D. Profane words are permitted when they do not cause interference to any other radii communication or signal

63. Which of the following VHF/UHF bands may not be used by Earth stations for satellite communications? [3AA-17.1]
A . 6 meters
B . 2 meters
c . 1.25 meters
D. 70 centimeters

SUBELEMENT 3AB - Operating Procedures (3 Questions)

64. What is the meaning of: 'Your report is five seven...? [3AB-1.1]
A Your signal is perfectly readable and moderately strong
B. Your signal is perfectly readable, but weak
C. Your signal is readable with considerable difficulty
D. Your signal is perfectly readable with near pure tone

65. What is the meaning of: 'Your report is three three...'? [3AB-1.2]
A. The contact is serial number thirty-three
B. The station is located at latitude 33 degrees
C. Your signal is readable with considerable difficulty and weak in strength
D. Your signal is unreadable, very weak in strength

66. What is the meaning of: 'Your report is five nine plus 20 dB..."? [3AB-1.3]
A. Your signal strength has increased by a factor of 100
B. Repeat your transmission on a frequency 20 kHz higher
C. The bandwidth of your signal is 20 decibels above linearity
D. A relative signal-strength meter reading is 20 decibels greater than strength 9

67. IHow should a QSO be initiated through a station in repeater operation? [3AB-2-1.1]
A. Say 'breaker, breaker 79"
B. Call the desired station and then identify your own station
C. Call "CQ" three times and identify three times
D. Wait for a "CQ" to be called and then answer it

66. Why should users of a station in repeater operation pause briefly between transmissions? [3AB-2-1.2]
A. To check the SWR of the repeater
B. To reach for pencil and paper for third party traffic
C. To listen for any hams wanting to break in
D. To dial up the repeater's autopatch

69. Why should users of a station in repeater operation keep their transmissions short and thoughtful?[3AB-2-1.3]
A. A long transmission may prevent someone with an emergency from using the repeater
B. To see if the receiving station operator is still awake
C. To give any non-hams that are listening a chance to respond
D. To keep long-distance charges down

70. What is the proper procedure to break into an'on-going QSO through a station in repeater operation? [3AB-2-1.4]
A Wait for the end of a transmission and start calling
B. Shout, 'break, break!' to show that you're eager to join the conversation
C. Turn on your 100-watt amplifier and override whoever is talking
D. Send your call sign during a break between transmissions

71. What is the purpose of repeater operation? [3AB-2-1.5]
A To cut your power bill by using someone's higher power system
B. To enable mobile and low-power stations to extend their usable range
C. To reduce your telephone bill
D. To call the ham radio distributor 50 miles away

72. What is meant by 'making the repeater time out.? [3AB-2-1.6]
A The repeater's battery supply has run out
B. The repeater's transmission time limit has expired during a single transmission
C. The warranty on the repeater duplexer has expired
D. The repeater is in need of repairs

73. During commuting rush hours, which types of operation should relinquish the use of the repeater? [3AB-2-1.7]
A Mobile operators
B. Low-power stations
C. Highway traffic information nets
D. Third-party communications nets

74. Why should simplex be used where possible instead of using a station in repeater operation? [3AB-2-2.1]
A. Farther distances can be reached
B. To avoid long distance toll charges
C. To avoid tying up the repeater unnecessarily
D. To permit the testing of the effectiveness of your antenna

75. When a frequency conflict arises between a simplex operation and a repeater operation, why does good amateur practice call for the simplex operation to move to another frequency? [3AB-2-2.2]
A The repeater's output power can be turned up to ruin the front end of the station in simplex operation
B. There are more repeaters than simplex operators
C. Changing the repeater's frequency is not practical
D. Changing a repeater frequency requires the authorization of the Federal Communications Commission

76. What is the usual input/output frequency separation for stations in repeater operation in the 2-meter wavelength band? [3AB-2-3.1]
A. 1 MHz
B. 1.6 MHz
C . 170 Hz
D. 0.6 MHz

77. What is the usual input/output frequency separation for stations in repeater operation in the 70-centimeter band? [3AB-2-3.2]
A. 1.6 MHz
B. 5 MHz
C. 600 kHz
D. 5 kHz

78. What is the usual input/output frequency separation for a 6-meter station in repeater operation? [3AB-2-3.3]
A. 1 MHz
B. 600 kHz
C. 1.6 MHz
D. 20 kHz

79. What is the usual input/output frequency separation for a 1.25-meter station in repeater operation? [3AB-2-3.4]
A. 1000 kHz
B. 600 kHz
C. 1600 kHz
D. 1.6 GHz

80. What is a repeater frequency coordinator? [3AB-2-4.1]
A. Someone who coordinates the assembly of a repeater station
B. Someone who provides advice on what kind of system to buy
C. The club's repeater trustee
D. A person or group that recommends frequency pairs for repeater usage

81. Why should local amateur communications be conducted on VHF and UHF frequencies? [3AB-3.1]
A. To minimize interference on HF bands capable of long-distance sky-wave communication
B. Because greater output power is permitted on VHF and UHF
C. Because HF transmissions are not propagated locally
D. Because absorption is greater at VHF and UHF frequencies

82. How can on-the-air transmissions be minimized during a lengthy transmitter testing or loading up procedure? [3AB-3.2]
A. Choose an unoccupied frequency
B. Use a dummy antenna
C. Use a non-resonant antenna
D. Use a resonant antenna that requires no loading up procedure

83. What is the proper Q signal to use to determine whether a frequency is in use before making a transmission? [3AB-3.3]
A. QRV?
6 . QRU?
c. QRL?
D. QRZ?

84. What is the proper distress calling procedure when using telephony? [3AB-4.1]
A. Transmit MAYDAY
B. Transmit QRRR
C. Transmit QRZ
D. Transmit SOS

85. What is the proper distress calling procedure when using telegraphy? [3AB-4.2]
A. Transmit MAYDAY
B. Transmit QRRR
C. Transmit QRZ
D. Transmit SOS

86. What is one requirement you must meet before you can participate in RACES drills? [3AB-5-1.1]
A You must be registered with ARRL
B. You must be registered with a local racing organization
C. You must be registered with the responsible civil defense organization
D. You need not register with anyone to operate RACES

87. What is the maximum amount of time allowed per week for RACES drills? [3AB-5-1.2]
A. Eight hours
B. One hour
C. As many hours as you want
D. Six hours, but not more than one hour per day

88. How must you identify messages sent during a RACES drill? [3AB-5-2.1]
A. As emergency messages
B. As amateur traffic
C. As official government messages
D. As drill or test messages

89. What is the term used to describe first-response communications in an emergency situation? [3AB-6-1.1]
A. Tactical communications
B. Emergency communications
C. Formal message traffic
D. National Traffic System messages

96. What is one reason for using tactical call signs such as 'command post' or 'weather center' during an emergency? [3AB-6-1.2]
A. They keep the general public informed about what is going on
B. They promote efficiency and coordination in public-service communications activities
C. They are required by the FCC
D. They promote goodwill among amateurs

91. What is the term used to describe messages sent into or out of a disaster area that pertain to a person's well being? [3AB-6-2.1]
A. Emergency traffic
B. Tactical traffic
C. Formal message traffic
D. Health and welfare traffic

92. Why is it important to provide a means of operating your amateur station separate from the commercial AC power lines? [3AB-6-3.1]
A. So that you can take your station mobile
B. So that you can provide communications in an emergency
C. So that you can operate field day
D. So that you will comply with Subpart 97.169 of the FCC Rules

93. Which type of antenna would be a good choice as part of a portable HF amateur station that could be set up in case of a communications emergency? [3AB-6-3.2]
A. A three-element quad
B. A three-element Yagi
C. A dipole
D. A parabolic dish

SUBELEMENT 3AC - Radio-Wave Propagation (3 Questions)

94. What is the ionosphere? [3AC-1-1.1]
A. That part Of the upper atmosphere where enough ions and free electrons exist to affect radiiwave propagation
B. The boundary between two air masses of different temperature and humidity, along which radio waves can travel
C. The ball that goes on the top of a mobile whip antenna
D. That part of the atmosphere where weather takes place

95. What is the region of the outer atmosphere that makes long-distance radio communications possible as a result of bending of radio waves? [3AC-1-1.2]
A. Troposphere
B. Stratosphere
C. Magnetosphere
D. ionosphere

96. What type of solar radiation is most responsible for ionization in the outer atmosphere? [3AC-1-1.3]
A Thermal
B. ionized particle
C. Ultraviolet
D. Microwave

97. Which ionospheric layer limits daytime radio communications in the 80-meter wavelength band to short distances? [3AC-1-2.1]
A D layer
B. F1 layer
C. E layer
D. F2 layer

98. What is the lowest ionospheric layer? [3AC-1-2.2]
A. The A layer
B. The D layer
C. The E layer
D. The F layer

99. What is the lowest region of the ionosphere that is useful for longdistance radio wave propagation? [3AC-1-3.1]
A The D layer
B. The E layer
C. The F1 layer
D. The F2 layer

100. Which layer of the ionosphere is mainly responsible for long-distance sky-wave radio communications? [3AC-1-4.1]
A. D layer
B. E layer
C. F1 layer
D. F2 layer

101. What are the two distinct sub-layers of the F layer of the ionosphere during the daytime? [3AC-1-4.2]
A. Troposphere and stratosphere
B. F1 and F2
C. Electrostatic and electromagnetic
D. D and E

102. Which two daytime ionospheric layers combine into one layer at night? [3AC-1-4.3]
A. E and F1
B. D and E
C. F1 and F2
D. El and E2

103. Which layer of the ionosphere is most responsible for absorption of radio signals during daylight hours? [3AC-2.1]
A The E layer
B. The F1 layer
C. The F2 layer
D. The D layer

104. When is ionospheric absorption most pronounced? [3AC-2.2]
A. When tropospheric ducting occurs
B. When radio waves enter the D layer at low angles
C. When radio waves travel to the F layer
D. When a temperature inversion occurs

105. During daylight hours, what effect does the D layer of the ionosphere have on 80-meter radio waves? [3AC-2.3]
A. The D layer absorbs the signals
B. The D layer bends the radio waves out into space
C. The D layer refracts the radio waves back to earth
D. The D layer has little or no effect on 80-meter radio wave propagation

106. What causes ionospheric absorption of radio waves? [3AC-2.4]
A. A lack of D layer ionization
B. D layer ionization
C. The presence of ionized clouds in the E layer
D. Splitting of the F layer

107. What is usually the condition of the ionosphere just before sunrise? [3AC-3.1]
A. Atmospheric attenuation is at a maximum
B. Ionization is at a maximum
C. The E layer is above the F layer
D. 'Ionization is at a minimum

106. At what time of day does maximum ionization of the ionosphere occur? [3AC-3.2]
A. Dusk
B. Midnight
c . Midday
D. Dawn

109. Minimum ionization of the ionosphere occurs daily at what time? [3AC-3.3]
A. Shortly before dawn
B. Just after noon
C. Just after dusk
D. Shortly before midnight

110. When is E layer ionization at a maximum? [3AC-3.4]
A . Dawn
B. Midday
C. Dusk
D . Midnight

111. What is the name for the highest radio frequency that will be refracted back to earth? [3AC-4.1]
A. Lowest usable frequency
B. Optimum working frequency
C. Ultrahigh frequency
D. Critii frequency

112 What causes the maximum usable frequency to vary? [3AC-4.2]
A. Variations in the temperature of the air at ionospheric levels
B. Upper-atmospheric wind patterns
C. The amount of ultraviolet and other types of radiation received from the sun
D. Presence of ducting

113. What does the term maximum usable frequency refer to? [3AC-4.3]
A. The maximum frequency that allows a radio signal to reach its destination in a single hop
B. The minimum frequency that allows a radio signal to reach its destination in a single hop
C. The maximum frequency that allows a radio signal to be absorbed in the lowest ionospheric layer
D. The minimum frequency that allows a radio signal to be absorbed in the lowest ionospheric layer

114. When two stations are within each other's skip zone on the frequency being used, what mode of propagation would it be desirable to use? [3AC-5.1]
A. Ground wave propagation
B. Sky wave propagation
C. Scatter-mode propagation
D. Ionospheric ducting propagation

115. You are in contact with a distant station and are operating at a frequency close to the maximum usable frequency. If the received signals are weak and somewhat distorted, what type of propagation are you probably experiencing? [3AC-5.2]
A Tropospheric ducting
B. Line-of-sight propagation
C. Backscatter propagation
D. Waveguide propagation

116. What is the transmission path of a wave that travels directly from the transmitting antenna to the receiving antenna called? [3AC-6.1]
A. Line of sight
B. Theskywave
C. The linear wave
D. The plane wave

117. How are VHF signals within the range of the visible horizon propagated? [3AC-6.2]
A. By sky wave
B. By direct wave
C. By plane wave
D. By geometric wave

116. Ducting occurs in which region of the atmosphere? [3AC-7.1]
A. F2
B. Ionosphere
C. Troposphere
D. Stratosphere

119. What effect does tropospheric bending have on 2-meter radio waves? [3AC-7.2]
A. It increases the distance over which they can be transmitted
B. It decreases the distance over which they can be transmitted
C. It tends to garble 2-meter phone transmissions
D. It reverses the sideband of 2-meter phone transmissions

120. What atmospheric phenomenon causes tropospheric ducting of radio waves? [3AC-7.3]
A. A very low pressure area
B. An aurora to the north
C. Lightning between the transmitting and receiving station
D. A temperature inversion

121. Tropospheric ducting occurs as a result of what phenomenon? [3AC-7.4]
A. A temperature inversion
B. Sun spots
C. An aurora to the north
D. Lightning between the transmitting and receiving station

122. What atmospheric phenomenon causes VHF radio waves to be propagated several hundred miles through stable air masses over oceans? [3AC-7.5]
A Presenceofamaritimepolarairmass
B. A widespread temperature inversion
C. An overcast of cirriform clouds
D. Atmospheric pressure of roughly 29 inches of mercury or higher

123. In what frequency range does tropospheric ducting occur most often? [3AC-7.6]
A. LF
B. MF
C. HF
D. VHF

SUBELEMENT 3AD - Amateur Radio Practice (4 Questions)

124. Where should the green wire in an AC line cord be attached in a power supply? [3AD-1-1.1]
A Tothefuse
B. To the "hot" side of the power switch
C. Tothechassii
D. To the meter

126. Where should the black (or red) wire in a three-wire line cord be attached in a power supply? [3AD-1-1.21
A To the filter capacitor
B. To the DC ground
C. To the chassis
D. To the fuse

126. Where should the whiie wire in a three-wire line cord be attached in a power supply? [3AD-1-1.3]
A To the side of the transformer's primary winding that has a fuse
B. To the side of the transformer's primary winding without a fuse
C. To the black wire
D. To the rectifier junction

127. Why is the retaining screw in one terminal of a light socket made of brass while the other one is silver colored? [3AD-1-1.4]
A To prevent galvanic action
B. To indicate correct wiring polarity
C. To better conduct current
D. To reduce skin effect

126. How much electrical current flowing through the human body is usually fatal? [3AD-1-2.1]
A. As little as 100 milliamperes may be fatal
B. Approximately 10 amperes is required to be fatal
C. More than 20 amperes is needed to kill a human being
D. No amount of current will harm you. Voltages of over 2000 volts are always fatal, however

129. What is the minimum voltage considered to be dangerous to humans? [3AD-1-2.2]
A 30 volts
B. 100 volts
c. 1060 volts
D. 2060 volts

130. How much electrical current flowing through the human body is usually painful? [3AD-1-2.3]
A As little as 60 milliamperes may be painful
B. Approximately '10 amperes is required to be painful
C. More than 20 amperes is needed to be painful to a human being
D. No amount of current will be painful. Voltages of over 2000 volts are always painful, however

131. Where should the main power-line switch for a high voltage power supply be situated? [3AD-1-3.1]
A. Inside the cabinet, to interrupt power when the cabinet is opened
B. On the rear panel of the high-voltage supply
C. Where it can be seen and reached easily
D. This supply should not be switch-operated

132 How is a voltmeter typically connected to a circuit under test? [3AD-2-1.1]
A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit

133. How can the range of a voltmeter be extended? [3AD-2-2.1]
A. By adding resistance in series with the circuit under test
B. By adding resistance in parallel with the circuit under test
C. By adding resistance in series with the meter
D. By adding resistance in parallel with the meter

134. How is an ammeter typically connected to a circuit under test? [3AD-3-1.1]
A. In series with the circuit
B. In parallel with the circuit
C. In quadrature with the circuit
D. In phase with the circuit

135. How can the range of an ammeter be extended? [3AD-3-2.1]
A By adding resistance in series with the circuit under test
B. By adding resistance in parallel with the circuit under test
C. By adding resistance in series with the meter
D. By adding resistance in parallel with the meter

136. What is a multimetet? [3AD-4.1]
A. An instrument capable of reading SWR and power
B. An instrument capable of reading resistance, capacitance and inductance
C. An instrument capable of reading resistance and reactance
D. An instrument capable of reading voltage, current and resistance

137. Where in the antenna transmission line should a peak-reading wattmeter be attached to determine the transmitter output power? [3AD-5-1.1]
A At the transmitter output
B. At the antenna feed point
C. One-half wavelength from the antenna feed point
D. One-quarter wavelength from the transmitter output

138. For the most accurate readings of transmitter output power, where should the RF wattmeter be inserted? [3AD-5-1.2]
A The wattmeter should be inserted and the output measured onequarter wavelength from the antenna feed point
B. The wattmeter should be inserted and the output measured one-half wavelength from the antenna feed point
C. The wattmeter should be inserted and the output power measured at the transmitter antenna jack
D. The wattmeter should be inserted and the output power measured at the Transmatch output

139. At what line impedance are RF wattmeters usually designed to operate? [3AD-5-1.3]
A. 25 ohms
B. 50 ohms
C. 100 ohms
D. 300 ohms

140. What is a directional wattmeter? [3AD-5-1.4]
A , An instrument that measures forward or reflected power
B . An instrument that measures the directional pattetn of an antenna
C. An instrument that measures the energy consumed by the transmitter
D. An instrument that measures thermal heating in a load resistor

141. If a directional RF wattmeter indicates 96 watts forward power and 10 watts reflected power, what is the actual transmitter output power? [3AD-5-2.1]
A 10 watts
B. 8Owatts
c. 9owatts
D. 100 watts

142. If a directional RF wattmeter indicates 96 watts forward power and 4 watts reflected power, what is the actual transmitter output power? [3AD-5-2.2]
A. 80 watts
B. 88watts
c. 92 watts
D . 100 watts

143. What is a marker generator? [3AD-6.1]
A. A high-stability oscillator that generates a series of reference signals at known frequency intervals
B. A low-stability oscillator that "sweeps" through a band of frequencies
C. An oscillator often used in aircraft to determine the crafts location relative to the inner and outer markers at airports
D. A high-stabilii oscillator whose output frequency and amplitude can be varied over a wide range

144. What type of circuit is used to inject a frequency calibration signal into a communications receiver? [3AD-6.2]
A. A product detector
B. A receiver incremental tuning circuit
C. A balanced modulator
D. A crystal calibrator

145. How is a marker venerator used? [3AD-6.3]
A. To calibrate the tuning dial on a receiver
B. To calibrate the volume control on a receiver
C. To test the amplitude linearity of an SSB transmitter
D. To test the frequency deviation of an FM transmitter

146. What piece of test equipment produces a stable, low-level signal that can be set to a specific frequency? [3AD-7.1]
A. A wavemeter
B. A reflectometer
C. A signal generator
D. A balanced modulator

147. What is an RF signal nenerator commonly used for? [3AD-7.2]
A. Measuring RF signal ampliie
B. Aligning receiver tuned circuits
C. Adjusting the transmitter impedance-matching network
D. Measuring transmission line impedance

148. What is a reflectometet? [3AD-8-1.1]
A. An instrument used to measure signals reflected from the ionosphere
B. An instrument used to measure radiation resistance
C. An instrument used to measure transmission-line impedance
D. An instrument used to measure standing wave ratio

149. What is the device that can indicate-an impedance mismatch in an antenna system? [3AD-8-1.2]
A. A field-strength meter
B. A set of lecher wires
C. A wavemeter
D. A reflectometer

150. For best accuracy when adjusting the impedance match between an antenna and feed line, where should the match-indicating device be inserted? [3AD-8-2.1]
A. At the antenna feed point
B. At the transmitter
C. At the midpoint of the feed line
D. Anywhere along the feed line

151. Where should a reflectometer be inserted into a long antenna transmission line in order to obtain the most valid standing wave ratio indication? [3AD-8-2.2]
A. At any quarter-wavelength interval along the transmission line
B. At the receiver end
C. At the antenna end
D. At any even half-wavelength interval along the transmission line

152. When adjusting a transmitter filter circuit, what device is connected to the transmitter output? [3AD-9.1]
A. A multimeter
B. A set of Litz wires
C. A receiver
D. A dummy antenna

153. What is a dummy antenna? [3AD-9.2]
A. An isotropic radiator
B. A nonradiating load for a transmitter
C. An antenna used as a reference for gain measurements
D. The image of an antenna, located below ground

154. Of what materials may a dummy antenna be made? [3AD-9-3]
A. A wire-wound resistor
B. A diode and resistor combination
C. A noninductive resistor
D. A coil and capacitor combination

155. What station accessory is used in place of an antenna during transmitter tests so that no signal is radiated? [3AD-9.4]
A. A Transmatch
B. A dummy antenna
C. A low-pass filter
D. A decoupling resistor

156. What is the purpose of a dummy load? [3AD-9.5]
A. To allow off-the-air transmitter testing
B. To reduce output power for QRP operation
C. To give comparative signal reports
D. To allow Transmatch tuning without causing interference

157. How many watts should a dummy load for use wlth a 100-watt single-sideband phone transmitter be able to dissipate? [3AD-9.6]
A. A minimum of 100 watts continuous
B. A minimum of 141 watts continuous
C. A minimum of 175 watts continuous
D. A minimum of 200 watts continuous

188. What is an S-meter? [3AD-10.1]
A. A meter used to measure sideband suppression
B. A meter used to measure spurious emissions from a transmitter
C. A meter used to measure relative signal strength in a receiver
D. A meter used to measure solar flux

159. A meter that is used to measure relative signal strength in a receiver is known as what? [3AD-10.2]
A. An S-meter
B. An FIST-meter
C. A signal deviation meter
D. An SSB meter

160. Large amounts of RF energy may cause damage to body tissue, depending on the wavelength of the signai, the energy density of the RF fieid, and other factors. How does RF energy effect body tissue? [3AD-11-1.1]
A. it causes radiation poisoning
B. It heats the tissue
C. It cools the tissue
D. it produces genetic changes in the tissue

161. Whiih body organ is most susceptible to damage from the heating effects of radio frequency radiation? [3AD-1 l-l .2]
A. Eyes
B. Hands
C. Heart
D. Liver

162. Scientists have devoted a great deal of effort to determine safe RF exposure limits. What organization has estabiiihed an RF protection guide? [3AD-1 l-2.1]
A. The Institute of Electrical and Electronics Engineers
B. The American Radio Reiay League
C. The Environmental Protection Agency
D. The American National Standards Institute

163. What is the purpose of the ANSI RF protection guide? [3AD-11-2.2]
A. it protects you from unscrupulous radio dealers
B. it sets RF exposure limits under certain circumstances
C. It sets transmitter power limits
D. it sets antenna height requirements

164. The American National Standards Institute RF protection guide sets RF exposure limits under certain circumstances. In what frequency range is the maximum exposure level the most stringent (lowest)? [3AD-11-2.3]
A . 3 to 30 MHz
B. 30 to 300 MHz
C. 300 to 3000 MHz
D. Above 1.5 GHz

165. The American National Standards Institute RF protection guide sets RF exposure limits under certain circumstances. Why is the maximum exposure level the most stringent (lowest) in the ranges between 30 MHz and 300 MHz? [3AD-11-2.4]
A. There are more transmitters operating in this frequency range
B. There are fewer transmitters operating in this frequency range
C. Most transmissii in this frequency range are for an extended time
D. Human body lengths are close to whoie-body resonance in that range

166. The American National Standards Institute RF protection guide sets RF exposure limits under certain circumstances. What is the maximum safe power output to the antenna terminal of a hand-held VHF or UHF radio, as set by thii RF protection guide? [3AD-11-2.5]
A 125 milliwatts
B . 7 watts
c . 10 watts
D. 25 watts

167. After you make intemai tuning adjustments to your VHF power amplifier, what should you do before you turn the amplifier on? [3AD-11-3.1]
A. Remove ail ampiiier shielding to ensure maximum cooling
B. Connect a noise bridge to eliminate any interference
C. Be certain all amplifier shielding is fastened in place
D. Be certain no antenna is attached so that you will not cause any interference

SUBELEMENT 3AE - Electrical Principles (2 Questions)

166. What is meant by the term resistance? [3AE-1-1.1]
A. The opposition to the flow of current in an electric circuit containing inductance
B. The opposition to the flow of current in an electric circuit containing capacitance
C. The opposition to the flow of current in an electric circuit containing reactance
D. The opposition to the flow of current in an electric circuit that does not contain reactance

169. What is an ohm? [3AE-1-2.1]
A. The basic unit of resistance
B. The basic unit of capacitance
C. The basic unit of inductance
D. The basic unit of admittance

170. What is the unit measurement of resistance? [3AE-1-2.2]
A. Volt
B. Ampere
C. Joule
D. Ohm

171, Two equal-value resistors are connected in series. How does the total resistance of this combination compare with the value of either resistor by itself? [3AE-1-3.1]
A. The total resktance is half the value of either resistor
B. The total resistance is twice the value of either resistor
C. The total resistance is the same as the value of either resistor
D. The total resistance is the square of the value of either resistor

172. How does the total resistance of a string of series-connected resistors compare to the values of the individual resistors? [3AE-1-3.2]
A. The total resistance is the square of the sum of all the individual resistor values
B. The total resistance is the square root of the sum of the individual resistor values
C. The total reslstance Is the sum of the squares of the indiildual resistor values
D. The total resistance is the sum of all the individual resistance values

173. Two equal-value resistors are connected in parallel. How does the total resistance of this combination compare with the value of either resistor by itself? [3AE-1-4.1]
A. The total resistance is twice the value of either resistor
B. The total resistance is half the value of either resistor
C. The total resistance is the square of the value of either resistor
D. The total resistance is the same as the value of either resistor

174. How does the total resistance of a string of parallel-connected resistors compare to the values of the individual resistors? [3AE-1-4.2]
A. me total resistance is the square of the sum of the resistor values
B. The total resistance is more than the highest-value resistor in the combination
C. The total resistance is less than the smallest-value resistor in the combination
D. The total resistance is same as the highest-value resistor in the combination

175. What is Ohm's Law? [3AE-2.1]
A. A mathematical relationship between resistance, voltage and power in a circuit
B. A mathematical relationship between current, resistance and power in a circuit
C. A mathematical relationship between current, voltage and power in a circuit
D. A mathematical relationship between resistance, current and applied voltage in a circuit

176. How is the current in a DC circuit calculated when the voltage and resistance are known? [3AE-2.2]
A. I = E / R
B. P = I x E
C. I = R x E
D. I = E x R

177. What is the input resistance of a load when a 12-volt battery supplies 0.25 amperes to it? [3AE-2.3]
A. 0.02 ohms
B. 3 ohms
C. 48 ohms
D. 480 ohms

178. The product of the current and what force gives the electrical power in a circuit? [3AE-2.4]
A. Magnetomotive force
B. Centripetal force
C. Electrochemical force
D. Electromotive force

179. What is the input resistance of a load when a 1 P-volt battery supplies 0.15 amperes to it? [3AE-2.5]
A. 8ohms
B. 80 ohms
C. 100 ohms
D. 800 ohms

180. When 120 volts is measured across a 4700-ohm resistor, approximately how much current is flowing through it? [3AE-2.6]
A. 39 amperes
B. 3.9 amperes
C. 0.26 ampere
D. 0.028 ampere

181. When 120 volts is measured across a 47000-ohm resistor, approximately how much current is flowing through it? [3AE-2.7]
A. 392 A
B. 39.2 A
C. 26 mA
D. 2.6 mA

182. When 12 volts is measured across a 4700-ohm resistor, approximately how much current is flowing through it? [3AE-2.8]
A. 2.6 mA
B. 26 mA
C. 39.2 A
D. 392 A

183. When 12 volts is measured across a 47000-ohm resistor, approximately how much current is flowing through it? [3AE-2.9]
A. 255 uA
B. 255 mA
C. 3917 mA
D. 3917A

184. What is the term used to describe the ability of a component to store energy in a magnetic field? [3AE-3-1.1]
A. Admittance
B. Capacitance
C. Inductance
D. Resistance

185. What is the basic unit of inductance? [3AE-3-2.1]
A Coulomb
B. Farad
C. Henry
D. Ohm

186. What is a [3AE-3-2.2]
A. The basic unit of admittance
8. The basic unit of capacitance
C. The basic unit of inductance
D. The basic unit of resistance

187. What is a microhenw? [3AE-3-2.3]
A A basic unit of inductance equal to 1 0\-12/ henrys
B. A basic unit of inductance equal to 10\-6/ henrys
C. A basic unit of inductance equal to 10\-3/ henrys
D. A basic unit of inductance equal to 10\6/ henrys

188. What is a millihenry? [3AE-3-2.4]
A. A basic unit of inductance equal to 10\-12/ henrys
B. A basic unit of inductance equal to 10\-6/ henrys
C. A basic unit of inductance equal to 10\-3/ henrys
D. A basic unit of inductance equal to 10\6/ henrys

189. Two equal-value inductors are connected in series. How does the total inductance of this combination compare with the value of either inductor by itself? [3AE-3-3.1]
A. The total inductance is half the value of either inductor
B. The total inductance is twice the value of either inductor
C. The total inductance is equal to the value of either inductor
D. No comparison can be made without knowing the exact inductances

190. How does the total inductance of a string of series-connected inductors compare to the values of the individual inductors? [3AE-3-3.2]
A. The total inductance is equal to the average of ail the individual inductances
B. The total inductance is equal to fess than the value of the smallest inductance
C. The total inductance is equal to the sum of all the indiiuai inductances
D. No comparison can be made without knowing the exact inductances

191. Two equal-value inductors are connected in parallel. How does the total inductance of this combination compare with the value of either inductor by itself? [3AE-3-4.1]
A. The total inductance is half the value of either inductor
B. The total inductance is twice the value of either inductor
C. The total inductance is equal to the square of either inductance
D. No comparison can be made without knowing the exact inductances

192. How does the total inductance of a string of parallel-connected inductors compare to the values of the individual inductors? [3AE-3-4.2]
A. The total inductance is equal to the sum of the inductances in the combination
B. The total inductance is less than the smallest inductance value in the combination
C. The total inductance is equal to the average of the inductances in the combination
D. No comparison can be made without knowing the exact inductances

193. What is the term used to describe the ability of a component to store energy in an electric field? [3AE-4-1.1]
A. Capacitance
B. inductance
C. Resistance
D. Tolerance

194. What is the basic unit of capacitance? [3AE-4-2.1]
A. Farad
B. Ohm
c. volt
D. Ampere

195. What is a microfarad? [3AE-4-2.2]
A. A basic unit of capacitance equal to 10\-12/ farads
B. A basic unit of capacitance equal to 10\-6/ farads
C. A basic unit of capacitance equal to 10\-2/ farads
D. A basic unit of capacitance equal to 10\6/ farads

196. What is a picofarad? [3AE-4-2.3]
A A basic unit of capacitance equal to 10\-12/ farads
B. A bask unit of capacitance equal to 10\-6/ farads
C. A basic unit of capacitance equal to 10\-2/ farads
D. A basic unit of capacitance equal to 10\6/ farads

107. What is a farad? [3AE-4-2.4]
A The basic unit of resistance
B. The basic unit of capacitance
C. The basic unit of inductance
D. The basic unit of admittance

196. Two equal-value capacitors are connected in series. How does the total capacitance of this combination compare with the value of either capacitor by itself? [3AE-4-3.1]
A The total capacitance is twice the value of either capacitor
B. The totai capacitance is equal to the value of either capacitor
C. The total capacitance is half the value of either capacitor
D. No comparison can be made without knowing the exact capacitances

199. How does the total capacitance of a string of series-connected capacitors compare to the values of the individual capacitors? [3AE-4-3.2]
A. The total capacitance is equal to the sum of the capacitances in the combination
B. The total capacitance is less than the smallest value of capacitance in the combination
C. The total capacitance is equal to the average of the capacitances in the combination
D. No comparison can be made without knowing the exact capacitances

200. Two equal-value capacitors are connected in parallel. How does the total capacitance of thii combination compare with the value of either capacitor by itself? [3AE-4-4.1]
A The total capacitance is twice the value of either capacitor
B. The total capacitance is half the value of either capacitor
C. The total capacitance is equal to the value of either capacitor
D. No comparison can be made without knowing the exact capacitances

261. How does the total capacitance of a string of parallel-connected capacitors compare to the values of the individual capacitors? [3AE-4-4.2]
A The total capacitance is equal to the sum of the capacitances in the combination
B. The total capacitance is less than the smallest value of capacitance in the combination
C. The total capacitance is equal to the average of the capacitances in the combination
D. No comparison can be made without knowing the exact capacitances

SUBELEMENT 3AF - Circuit Components (2 Questions)

262. What are the four common types of resistor construction? [3AF-1-1.1]
A Carbon-film, metal-film, microfilm and wire-film
B. Carbon-composition, carbon-film, metal-film and wire-wound
C. Carbon-composition, carbon-film, electrolytic and metal-film
D. Carbon-film, ferrite, carbon-composition and metal-film

263. What is the primary function of a resistor? [3AF-1-2.1]
A To store an electric charge
B. To store a magnetic field
C. To match a high-impedance source to a low-impedance load
D. To limit the current in an electric circuit

204. What is a variable resistor? [3AF-1-2.2]
A A resistor that changes value when an AC voltage is applied to it
B. A device that can transform a variable voltage into a constant voltage
C. A resistor with a slide or contact that makes the resistance adjustable
D. A resistor that changes value when it is heated

205. What do the first three color bands on a resistor indicate? [3AF-1-3.1]
A. 'The value of the resistor in ohms
B. The resistance tolerance in percent
C. The power rating in watts
D. The value of the resistor in henrys

206. How can a carbon resistor's electrical tolerance rating be found? [3AF-1-3.2]
A. By using a wavemeter
B. By using the resistor's color code
C. By using Thevenin's theorem for resistors
D. By using the Baudot code

207. What does the fourth color band on a resistor indicate? [3AF-1-3.3]
A. The value of the resistor in ohms
B. The resistance tolerance in percent
C. The power rating in watts
D. The resistor composition

208. When the color bands on a group of resistors indicate that they all have the same resistance, what further information about each resistor is needed in order to select those that have nearly equal value? [3AF-1-3.4]
A. The working voltage rating of each resistor
B. The composition of each resistor
C. The tolerance of each resistor
D. The current rating of each resistor

299. Why do resistors generate heat? [3AF-1-4.1]
A. They convert electrical energy to heat energy
B. They exhibit reactance
C. Because of skin effect
D. To produce thermionic emission

210. Why would a large size resistor be substituted for a smaller one of the same resistance? [3AF-1-4.2]
A. To obtain better response
B. To obtain a higher current gain
C. To increase power dissipation capability
D. To produce a greater parallel impedance

211. What is the symbol used to represent a fixed resistor on schematic diagrams? (Please refer to Diagram 3AF-1-5.1) [3AF-1-5.1]
A. Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

212. What is the symbol used to represent a variable resistor on schematic diagrams. (Please refer to Diagram 3AF-1-5.2) [3AF-1-5.2]
A. Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

213. What is an inductor core? [3AF-2-1.1]
A. The point at which an inductor is tapped to produce resonance
B. A tight coil of wire used in a transformer
C. An insulating material placed between the plates of an inductor
D. The central portion of a coil; may be made from air, iron, brass or other material

214. What are the component parts of a coil? [3AF-2-1.2]
A. The wire in the winding and the core material
B. Two conductive plates and an insulating material
C. Two or more layers of silicon material
D. A donut-shaped iron core and a layer of insulating tape

215. Describe an inductor. [3AF-2-1.3]
A. A semiconductor in a conducting shield
B. Two parallel conducting plates
C. A straight wire conductor mounted inside a Faraday shield
D. A coil of conducting wire

216. For radio frequency power applications, which type of inductor has the least amount of loss? [3AF-2-1.4]
A. Magnetic wire
B. Iron core
C. Air core
D. Slug tuned

217. What is an inductor? [3AF-2-2.1]
A. An electronic component that stores energy in an electric field
B. An electronic component that converts a high voltage to a lower voltage
C. An electronic component that opposes DC while allowing AC to pass
D. An electronic component that stores energy in a magnetic field

218. What are the electrical properties of an inductor? [3AF-2-2.2]
A. An inductor stores a charge electrostatically and opposes a change in voltage
B. An inductor stores a charge electrochemically and opposes a change in current
C. An inductor stores a charge electromagnetically and opposes a change in current
D. An inductor stores a charge electromechanically and opposes a change in voltage

219. What factors determine the amount of inductance in a coil? [3AF-2-3.1]
A. The type of material used in the core, the diameter of the core and whether the coil is mounted horizontally or vertically
B. The diameter of the core, the number of turns of wire used to wind the coil and the type of metal used in the wire
C. The type of material used in the core, the number of turns used to wind the core and the frequency of the current through the coil
D. The type of material used in the core, the diameter of the core, the length of the coil and the number of turns of wire used to wind the coil

220. What can be done to raise the inductance of a 5-microhenry air-core coil to a 5-millihenry coil with the same physical dimensions? [3AF-2-3.2]
A. The coil can be wound on a nonconducting tube
B. The coil can be wound on an iron core
C. Both ends of the coil can be brought around to form the shape of a donut, or toroid
D. The coil can be made of a heavier-gauge wire

221. As an iron core is inserted in a coil, what happens to the inductance? [3AF-2-3.3]
A It increases
B. It decreases
C. It stays the same
D. It becomes voltagedependent

222. As a brass core is inserted in a coil, what happens to the inductance? [3AF-2-3.4]
A. It increases
B. It decreases
C. It stays the same
D. It becomes voftagedependent

223. What is the symbol used to represent an adjustable inductor on schematic diagrams? (Please refer to Diagram 3AF-2-4.1) [3AF-2-4.1]
A. Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

224. What is the symbol used to represent an iron-core inductor on schematic diagrams? (Please refer to Diagram 3AF-2-4.2) [3AF-2-4.2]
A. Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

225. What is the symbol used to represent an inductor wound over a toroidal core on schematic diagrams? (Please refer to Diagram 3AF-2-4.3) [3AF-2-4.3]
A Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

226. What is a capacitor dielectric? [3AF-3-1.1]
A. The insulating material used for the plates
B. The conducting material used between the plates
C. The ferrite material that the plates are mounted on
D. The insulating material between the plates

227. What are the component parts of a capacitor? [3AF-3-1.2]
A Two or more -conductive plates with an insulating material between them
B. The wire used in the winding and the core material
C. Two or more layers of silicon material
D. Two insulating plates with a conductive material between them

228. What is an electrolytic capacitor? [3AF-3-1.3]
A. A capacitor whose plates are formed on a thin ceramic layer
B. A capacitor whose plates are separated by a thin strip of mica insulation
C. A capacitor whose dielectric is formed on one set of plates through electrochemical action
D. A capacitor whose value varies with applied voltage

229 What is a paper capacitor? [3AF-3-1.4]
A. A capacitor whose plates are formed on a thin ceramic layer
B. A capacitor whose plates are separated by a thin strip of mica insulation
C. A capacitor whose plates are separated by a layer of paper
D. A capacitor whose dielectric is formed on one set of plates through electrochemical action

230. What is a capacitor? [3AF-3-2.1]
A. An electronic component that stores energy in a magnetic field
B. An electronic component that stores energy in an electric field
C. An electronic component that converts a high voltage to a lower voltage
D. An electronic component that converts power into heat

231. What are the electrical properties of a capacitor? [3AF-3-2.2]
A A capacitor stores a charge electrochemically and opposes a change in current
B. A capacitor stores a charge electromagnetically and opposes a change in current
C. A capacitor stores a charge electromechanically and opposes a change in voltage
D. A capacitor stores a charge electrostatically and opposes a change in voltage

232 What factors must be considered when selecting a capacitor for a circuit? [3AF-3-2.3]
A. Type of capacitor, capacitance and voltage rating
B. Type of capacitor, capacitance and the kilowatt-hour rating
C. The amount of capacitance, the temperature coefficient and the KVA rating
D. The type of capacitor, the microscopy coefficient and the temperature coefficient

233. How are the characteristics of a capacitor usually specified? [3AF-3-2.4]
A. In volts and amperes
B. In microfarads and volts
C. In ohms and watts
D. In millihenrys and amperes

234. What factors determine the amount of capacitance in a capacitor? [3AF-3-3.1]
A. The dielectric constant of the material between the plates, the area of one side of one plate, the separation between the plates and the number of plates
B. The dielectric constant of the material between the plates, the number of plates and the diameter of the leads connected to the plates
C. The number of plates, the spacing between the plates and whether the dielectric material is N type or P type
D. The dielectric constant of the material between the plates, the surface area of one side of one plate, the number of plates and the type of material used for the protective coating

235. As the plate area of a capacitor is increased, what happens to Its capacitance? [3AF-3-3.2]
A . Decreases
B. Increases
c . Stays the same
D. Becomes voltage dependent

236. As the plate spacing of a capacitor is increased, what happens to its capacitance? [3AF-3-3.3]
A. Increases
B. Staysthesame
C. Becomes voltage dependent
D. Decreases

237. What is the symbol used to represent an electrolytic capacitor on schematic diagrams? (Please refer to Diagram 3AF3-4.1) [3AF-3-4.1]
A. Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

238. What is the symbol used to represent a variable capacitor on schematic diagrams? (Please refer to Diiram 3AF3-4.2) [3AF-3-4.2]
A. Symbol A
B. Symbol B
C. Symbol C
D. Symbol D

SUBELEMENT 3AG - Practical Circuits (1 Question)

239. Which frequencies are attenuated by a low-pass filter? [3AG-1-1.1]
A. Those above its cut-off frequency
B. Those within its cutoff frequency
C. Those within 50 kHz on either side of its cut-off frequency
D. Those below its cut-off frequency

240. What circuit passes electrical energy below a certain frequency and blocks electrical energy above that frequency? [3AG-1-1.2]
A. A band-pass filter
B. A high-pass filter
C. An input filter
D. A low-pass filter

241. Why does virtually every modem transmitter have a built-in low-pass filter connected to its output? [3AG-1-2.1]
A. To attenuate frequencies below Its cutoff point
B. To attenuate low frequency interference to other amateurs
C. To attenuate excess harmonic radiation
D. To attenuate excess fundamental radiation

242. You believe that excess harmonic radiation from your transmitter is causing interference to your television receiver. What is one possible solution for this problem? [3AG-1-2.2]
A. Install a low-pass fiiter on the television receiver
8. Install a low-pass filter at the transmitter output
C. Install a high-pass filter on the transmitter output
D. Install a band-pass filter on the television receiver

243. What circuit passes electrical energy above a certain frequency and attenuates electrical energy below that frequency? [3AG-2-1. 1]
A. A band-passfilter
B. A high-pass filter
C. An input filter
D. A low-pass filter

244. Where is the proper place to install a high-pass film? [3AG-2-2. 1]
A. At the antenna terminals of a television receiver
B. Between a transmitter and a Transmatch
C. Between a Transmatch and the transmission line
D. On a transmitting antenna

245. Your Amateur Radio transmissions cause interference to your television receiver even though you have installed a low-pass filter at the transmitter output. What is one possible solution for this problem? [3AG-2-2.2]
A. install a high-pass filter at the transmitter terminals
B. install a high-pass fiiter at the television antenna terminals
C. install a low-pass filter at the television antenna terminals also
D. install a band-pass filter at the television antenna terminals

246. What circuit attenuates electrical energy above a certain frequency and below a lower frequency? [3AG-3-1.1]
A. A band-pass filter
B. A high-pass filter
C. An input filter
D. A low-pass filter

247. What general range of RF energy does a band-pass filter reject? [3AG-3-1.2]
A. All frequencies above a specified frequency
B. Ail frequencies below a specified frequency
C. All frequencies above the upper limit of the band in question
D. Ail frequencies above a specified frequency and below a lower specified frequency

243. The IF stage of a communications receiver uses a filter with a peak response at the intermediate frequency. What term describes this filter response? [3AG-3-2.1]
A . A band-pass filter
B. A high-pass filter
C. An input filter
D. A low-pass filter

249. What circuit is likely to be found in all types of receivers? [3AG-4-1.1]
A. An audio filter
B. A beat frequency oscillator
C. Adetector
D. An RF amplifier

250. What type of transmitter does this block diagram represent? (Please refer to Diagram 3AG-4-I .2) [3AG-4-1.2]
A. A simple packet-radii transmitter
B. A simple crystal-controlled transmitter
C. A single-sideband transmitter
D. A VFO-controlled transmitter

251. What type of transmitter does thii block diagram represent? (Please refer to Diagram 3AG-4 1 . 3) [3AG-4-1.3]
A. A simple packet-radio transmitter
B. A simple crystal-controlled transmitter
C. A single-sideband transmitter
D. A VFO-controlled transmitter

252. What is the unlabeled block (?) in this diagram? (Please refer to Diagram 3AG-4-1.4) [3AG-4-1.4]
A. An AGC circuit
B. A detector
C. A power supply
D. A VFO circuit

253. What type of device does this block diagram represent? (Please refer to Diagram 3AG-4-1.5) [3AG-4-1.5]
A. A double-conversion receiver
B. A variable-frequency oscillator
C. A simple superheterodyne receiver
D. A simple CW transmitter

254. What type of device does this block diagram represent? (Please refer to Diagram 3AG-4-2.1) [3AG-4-2.1]
A. A double-conversion receiver
B. A variable-frequency oscillator
C. A simple superheterodyne receiver
D. A simple FM receiver

266. What is the unlabeled block (?) in thii diagram? (Please refer to Diagram 3AG-4-2.2) [3AG-4-2.2]
A. A band-pass filter
B. A crystal oscillator
C. A reactance modulator
D. A rectifier modulator

SUBELEMENT 3AH - Signals and Emissions (2 Questions)

266. What is the meaning of the term modulation? [3AH-1.1]
A. The process of varying some characteristic of a carrier wave for the purpose of conveying information
B. The process of recovering audio information from a received signal
C. The process of increasing the average power of a single-sideband transmission
D. The process of suppressing the carrier in a singlesideband transmitter

267. If the modulator circuit of your FM transmitter fails, what emission type would likely result? [3AH-2-1.1]
A An unmodulated carrier wave
B. A phase modulated carrier wave
C. An amplitude modulated carrier wave
D. A frequency modulated carrier wave

266. What emission does not have sidebands resulting from modulation? [3AH-2-1.2]
A AM phone
B. Test
C. FM phone
D. RTTY

259. What is the FCC emission designator for a Morse code telegraphy signal produced by switching the transmitter output on and off? [3AH-2-2.1]
A. Test
B. AM phone
c. cw
D. RTTY

260. What is CW? [3AH-2-2.2]
A Morse code telegraphy using amplitude modulation
B. Morse code telegraphy using frequency modulation
C. Morse code telegraphy using phase modulation
D. Morse code telegraphy using pulse modulation

261. What Is RTTY? [3AH-2-3.1]
A. Amplitude-keyed telegraphy
B. Frequency-shift-keyed telegraphy
C. Frequency-modulated telephony
D. Phase-modulated telephony

262. What is the emission designation for telegraphy by frequency shii keying without the use of a modulating tone? [3AH-2-3.2]
A . RTTY
B. MCW
C. c w
D. Single-sideband phone

263. What emission type results when an on/off keyed audio tone is applied to the microphone input of an FM transmitter? [3AH-2-4.1]
A . RTTY
B. MCW
c . cw
D. Single-sideband phone

264. What is tone-modulated international Morse code telegraphy? [3AH-2-4.2]
A Telephony produced by audio fed into an FM transmitter
B. Telegraphy produced by on/off keyed audio tone fed into a CW transmitter
C. Telegraphy produced by on/off keying of the carrier amplitude
D. Telegraphy produced by an on/off keyed audio tone fed into an FM transmitter

265. What is the emission designated as "MCW"? [3AH-2-5.1]
A. Frequency-modulated telegraphy using audio tones
B. Frequency-modulated telephony
C. Frequency-modulated facsimile using audio tones
D. Phase-modulated television

266. In an ITU emission designator like Al A, what does the first symbol describe? [3AH-2-5.2]
A. The nature of the signal modulating the main carrier
B. The type of the information to be transmitted
C. me speed of a radiotelegraph transmission
D. The type of modulation of the main carrier

267. What emission type results when an AF shift keyer is connected to the microphone jack of an FM phone transmitter7 [3AH-2-5.3]
A. SS
B. RTTY
C. MCW
D. Image

266. In an ITU emission designator like F3B, what does the second symbol describe? [3AH-2-6.1]
A The nature of the signal modulating the main carrier
B. The type of modulation of the main carrier
C. The type of information to be transmitted
D. The frequency modulation index of a carrier

269. How would you transmit packet using an FM 2-meter transceiver? [3AH-2-6.2]
A Use your telegraph key to interrupt the carrier
B. Elate your FM transmitter with audio tones from a terminal node controller
C. Use your mike for telephony
D. Use your touch-tone (DTMF) key pad to signal in Morse code

270. What type of emission results when speaking into the microphone of a P-meter FM handheld transceiver? [3AH-2-7.1]
A Ampliie modulated phone
B. Code telegraphy
C. An unmodulated carrier wave
D. Frequency modulated phone

271. What emissiin type do most 2-meter FM transmitters transmit? [3AH-2-7.2]
A Interrupted pure carrier wave
B. Frequency modulated phone
C. Single-sideband voice emissions
D. Amplitude modulated carrier waves

272. What is the most important consideration when installing a lo-meter dipole inside an attic? [3AH-2-8.1]
A It will exhibit a low angle of radiation
B. The dipole must always be run horizontally polarized
C. It will be covered by an insulation to prevent fire and high enough to prevent being accidentally touched during transmission
D. Dipoles usually don't work in attics

273. Which type of transmitter will produce a frequency modulated carrier wave? [3AH-2-8.2]
A. A CW transmitter
B. An amplitude modulated transmitter
C. A single-sideband transmitter
D. A phase modulated transmitter

274. What is the term used to describe a constant-amplitude radiifrequency signal? [3AH-3.1]
A. An RF carrier
B. An AF carrier
C. A sideband carrier
D. A subcarrier

275. What is another name for an unmodulated radio-frequency signal? [3AH-3.2]
A AnAFcarrier
B. An RF carrier
C. A sideband carrier
D. A subcarrier

276. What characteristic makes FM telephony especially well-suited for local VHF/UHF radio communications? [3AH-4.1]
A. Good audio fidelity and intelligibilii under weak-signal conditions
B. Better rejection of multipath distortion than the AM modes
C. Good audio fidelity and high signal-to-noise ratio above a certain signal amplitude , threshold
D. Better carrier frequency stability than the AM modes

277.' What emission is produced by a transmitter using. a reactance modulator? [3AH-5.1]
A. CW
B. Unmodulated carrier
C. Single-sideband, suppressedcarrier phone
D. Phase modulated phone

276. What other emission does phase modulation most resemble? [3AH-5.2]
A. Amplitude modulation
B. Pulse modulation
C. Frequency modulation
D. Single-sideband modulation

279. Many communications receivers have several IF filters that can be selected by the operator. Why do these filters have diierent bandwidths? [3AH-6.1]
A. Because some ham bands are wider than others
B. Because different bandwidths help increase the receiver sensitivity
C. Because different bandwidths improve S-meter readings
D. Because some emission types occupy a wider frequency range than others

280. List the following signals in order of increasing bandwidth (narrowest signal first): CW, FM voice, RTTY, SSB voice. [3AH-6.2]
A. RTTY, CW, SSB voice, FM voice
B. CW, FM voice, RTTY, SSB voice
C. CW, RTTY, SSB voice, FM voice
D. CW, SSB voice, RTTY, FM voice

281. To what is the deviation of an FM transmission proportional? [3AH-7-1.1]
A. Only the frequency of the audio modulating signal
B. The frequency and the amplitude of the audio modulating signal
C. The duty cycle of the audio modulating signal
D. Onty the amplitude of the audio modulating signal

282. What is the result of overdeviation in an FM transmitter? [3AH-7-2.1]
A. Increased transmitter power consumption
B. Out-of-channel emissions (splatter)
C. increased transmitter range
D. Inadequate carrier suppression

283. What is splatter? [3AH-7-2.2]
A Interference to adjacent signals caused by 'excessive transmitter keying speeds
B. Interference to adjacent signals caused by Improper transmitter neutralization
C. Interference to adjacent signals caused by overmodulation of a transmitter
D. Interference to adjacent signals caused by parasitic oscillations at the antenna

SUBELEMENT 3AI - Antennas and Feed Lines (3 Questions)

284. What antenna type best strengthens signals from a particular direction while attenuating those from other directions? [3AI-1-1.I]
A A beam antenna
B. An isotropic antenna
C. A monopole antenna
D. A vertical antenna

286. What is a directional antenna? [3AI-1-1.2]
A An antenna whose parasitic elements are all constructed to be directors
B. An antenna that radiates in direct line-of-sight propagation, but not skywave or skip propagation
C. An antenna permanently mounted so as to radiate in only one direction
D. An antenna that radiates more strongly in some directions than others

286. What is a Yagi antenna? [3AI-1-1.3]
A. Half-wavelength elements stacked vertically and excited in phase
B. Quarter-wavelength elements arranged horizontally and excited out of phase
C. Half-wavelength linear driven element(s) with parasitically excited parallel linear elements
D. Quarter-wavelength, triangular loop elements

287. What is the general configuration of the radiating elements of a horizontally polarized Yagi? [3AI-1-1.4]
A. Two or more straight, parallel elements arranged in the same horizontal plane
B. Vertically stacked square or circular loops arranged in parallel horizontal planes
C. Two or more wire loops arranged in parallel vertical planes
D. A vertical radiator arranged in the center of an effective RF ground plane

288. What type of parasitic beam antenna uses two or more straight metal-tubing elements arranged physically parallel to each other? [3AI-1-1.5]
A A delta loop antenna
B. A quad antenna
C. A Yagi antenna
D. A Zepp antenna

289. How many directly driven elements does a Yagi antenna have? [3AI-1-1.6]
A. None; they are all parasitic
B. One
C. Two
D. All elements are directly driven

290. What is a parasitic beam antenna? [3AI-1-1.7]
A. An antenna where the director and reflector elements receive their RF excitation by induction or radiation from the driven element
B. An antenna where wave traps are used to assure magnetic coupling among the elements
C. An antenna where all elements are driven by direct connection to the feed line
D. An antenna where the driven element receives its RF excitation by induction or radiation from the directors

291. What is a cubical quad antenna? [3AI-1-2.1]
A. Four parallel metal tubes, each approximately 1/2 electrical wavelength long
B. Two or more parallel four-sided wire loops, each approximately one electrical wavelength long
C. A vertical conductor 1/4 electrical wavelength high, fed at the bottom
D. A center-fed wire 1/2 electrical wavelength long

292. What kind of antenna array is composed of a square full-wave closed loop driven element with parallel parasitic element(s)? [3AI-1-2.2]
A. Delta loop
B. Cubical quad
C. Dual rhombic
D. Stacked Yagi

293. Approximately how long is one side of the driven element of a cubical quad antenna? [3AI-1-2.3]
A 2 electrical wavelengths
B. 1 electrical wavelength
C. 1/2 electrical wavelength
D. 1/4 electrical wavelength

294. Approximately how long is the wire in the driven element of a cubical quad antenna? [3AI-1-241
A 1/4 electrical wavelength
B. 1/2 electrical wavelength
C. 1 electrical wavelength
D. 2 electrical wavelengths

295. What is a delta loop antenna? [3AI-1-3.1]
A A variation of the cubical quad antenna, with triangular elements
B. A large copper ring, used in direction finding
C. An antenna system composed of three vertical antennas, arranged in a triangular shape
D. An antenna made from several coils of wire on an insulating form

296. To what does the term horiiontal as applied to wave polarization refer? [3AI-2-1.1]
A The magnetic lines of force in the radio wave are parallel to the earth's surface
B. The electric lines of force in the radio wave are parallel to the earth's surface
C. The electric lines of force in the radio wave are perpendicular to the earth's surface
D. The radio wave will leave the antenna and radiate horizontally to the destination

297. What electromagnetic wave polarization does a cubical quad antenna have when the feed point is in the center of a horizontal side? [3AI-2-1.2]
A Circular
B. Helical
C. Horizontal
D. Vertical

293. What electromagnetic wave polarization does a cubical quad antenna have when all sides are at 45 degrees to the earth's surface and the feed point is at the bottom corner? [3AI-2-1.3]
A Circular
B. Helical
C. Horizontal
D. Vertical

299. What is the polarization of electromagnetic waves radiated from a half-wavelength antenna perpendicular to the earth's surface? [3AI-2-2.1]
A Circularly polarized waves
B. Horizontally polarized waves
c . Parabolically polarized waves
D. Vertically polarized waves

300. What is the electromagnetic wave polarization of most man-made electrical noise radiation in the HF-VHF spectrum? [3AI-2-2.2]
A Horizontal
B . Left-hand circular
C. Right-hand circular
D . Vertical

301. Towhatdoesthetermverticafasappliito wave polarization refer? [3AI-2-2.3]
A The electric lines of force in the radio wave are parallel to the earth's surface
B. The magnetic lines of force in the radio wave are perpendicular to the earth's surface
C. The electric lines of force in the radlo wave are perpendicular to the earth's surface
D. The radio wave will leave the antenna and radiate vertically into the ionosphere

302. What electromagnetic wave polarization does a cubical quad antenna have when the feed point is in the center of a vertical side? [3AI-2-2.4]
A Circular
B. Helical
C. Horizontal
D. Vertical

303. What electromagnetic wave polarization does a cubical quad antenna have when all sides are at 45 degrees to the earth's surface and the feed point is at a side comer? [3AI-2-2.5]
A. Circular
B. Helical
C. Horizontal
D. Vertical

304. What is meant by the term standing wave ratio? [3AI-3-1 .1]
A The ratio of maximum to minimum inductances on a feed line
B. The ratio of maximum to minimum resistances on a feed line
C. The ratio of maximum to minimum impedances on a feed line
D. The ratio of maximum to minimum voltages on a feed line

305. What is standing wave ratio a measure of? [3AI-3-1.2]
A. The ratio of maximum to minimum voltage on a feed line
B. The ratio of maximum to minimum reactance on a feed line
C. The ratio of maximum to minimum resistance on a feed line
D. The ratio of maximum to minimum sidebands on a feed line

306. What is meant by the term forward power? [3AI-3-2.1]
A. The power traveling from the transmitter to the antenna
B. The power radiated from the front of a directional antenna
C. The power produced during the positive half of the RF cycle
D. The power used to drive a linear amplifier

307. What is meant by the term reflected power? [3AI-3-2.2]
A. The power radiated from the back of a directional antenna
B. The power returned to the transmitter from the antenna
C. The power produced during the negative half of the RF cycle
D. Power reflected to the transmitter site by buildings and trees

308. What happens to the power loss in an unbalanced feed line as the standing wave ratio increases? [3AI-3-3.1]
A It is unpredictable
B. It becomes nonexistent
C. It decreases
D. It increases

309. What type of feed line is best suited to operating at a high standing wave ratio? [3AI-3-3.2]
A. Coaxial cable
B. Flat ribbon 'twin lead
C. Parallel open-wire line
D. Twisted pair

310. What happens to RF energy not delivered to the antenna by a lossy coaxial cable? [3AI-3-3.3]
A. It is radiated by the feed line
B. It is returned to the transmitter's chassis ground
C. Some of it is dissipated as heat in the conductors and dielectric
D. It is canceled because of the voltage ratio of forward power to reflected power in the feed line

311. What is a balanced line? [3AI-4-1.1]
A. Feed line with one conductor connected to ground
B. Feed line with both conductors connected to ground to balance out harmonics
C. Feedlinewiththeouter conductorconnected to ground at even intervals
D. Feed line with neither conductor connected to ground

312 What is an unbalanced line? [3AI-4-1.2]
A. Feed line with neither conductor connected to ground
B. Feed line with both conductors connected to ground to suppress harmonics
C. Feed line with one conductor connected to ground
D. Feed line with the outer conductor connected to ground at uneven intervals

313. What is a balanced antenna? [3AI-4-2.1]
A. A symmetrical antenna with one side of the feed point connected to ground
B. An antenna (or a driven element in an array) that is symmetrical about the feed point
C. A symmetrical antenna with both sides of the feed point connected to ground, to balance out harmonics
D. An antenna designed *to* be mounted in the center

314. What is an unbalanced antenna? [3AI-4-2.2]
A. An antenna (or a driven element in an array) that is not symmetrical about the feed point
B. A symmetrical antenna, having neither half connected to ground
C. An antenna (or a driven element in an array) that is symmetrical about the feed point
D. A symmetrical antenna with both halves coupled to ground at uneven intervals

315. What device can be installed on a balanced antenna so that it can be fed through a coaxial cable? [3AI-4-3.1]
A. A balun
B. A loading coil
C. A triaxial transformer
D. A wavetrap

316. What is a balun? [3AI-4-3.2]
A. A device that can be used to convert an antenna designed to be fed at the center so that it may be fed at one end
B. A device that may be installed on a balanced antenna so that it may be fed with unbalanced feed line
C. A device that can be installed on an antenna to produce horizontally polarized or vertically polarized waves
D. A device used to allow an antenna to operate on more than one band

317. List the following types of feed line in order of increasing attenuation per 100 feet of line (list the line with the lowest attenuation first): RG-8, RG-58, RG-174 and open-wire line. [3AI-5-1.1]
A RG-174, RG-58, RG-8, open-wire line
B. RG-8, open-wire line, RG-58, RG-174
C. open-wire line, RG-8, RG-58, RG-174
D. open-wire line, RG-174, RG-58, RG-8

318. You have installed a tower 150 feet from your radio shack, and have a 6-meter Yagi antenna on top. Which of the following feed lines should you choose to feed this antenna: [3AI-5-1.2]
RG-8, RG-58, RG-59 or RG-174?
A RG-8
B. RG-58
C. RG-59
D. RG-174

319. You have a 200-foot coil of RG-58 coaxial cable attach& to your antenna, but the antenna is only 50 feet from your radio. To minimize feed-line loss, what should you do with the excess cable? [3AI-5-2.1]
A Cut off the excess cable to an even number of wavelengths long
B. Cut off the excess cable to an odd number of wavelengths long
C. Cut off the excess cable
D. Roll the excess cable into a coil a tenth of a wavelength in diameter

320. How does feed-line length affect signal loss? [3AI-5-2.2]
A. The length has no effect on signal loss
B. As length increases, signal loss increases
C. As length decreases, signal loss increases
D. The length is inversely proportional to signal loss

321. What is the general relationship between frequencies passing through a feed line and the losses in the feed line? [3AI-5-3.1]
A. Loss is independent of frequency
B. Loss increases with increasing frequency
C. Loss decreases with increasing frequency
D. There is no predictable relationship

322. As the operating frequency decreases, what happens to conductor losses in a feed line? [3AI-5-3.2]
A The losses decrease
B. Thelosses increase
C. The losses remain the same
D. The losses become infinite

323. As the operating frequency increases, what happens to conductor losses in a feed line? [3AI-5-3.3]
A. The losses decrease
B. The losses increase
C. The losses remain the same
D. The losses decrease to zero

324. You are using open-wire feed line in your amateur station. Why should you ensure that no one can come in contact with the feed tine while you are transmitting? [3AI-6-1.1]
A. Because contact with the feed line while transmitting will cause a short circuit, probably damaging your transmitter
B. Because the wire is so small they may break it
C. Because contact with the feed line while transmitting will cause parasitic radiation
D. Because high RF voltages can be present on open-wire feed line

325. How can you minimize exposure to radio frequency energy from your transmitting antennas? [3AI-6-2.1]
A. Use vertical polarization
B. Use horizontal polarization
C. Mount the antennas where no one can come near them
D. Mount the antenna close to the ground

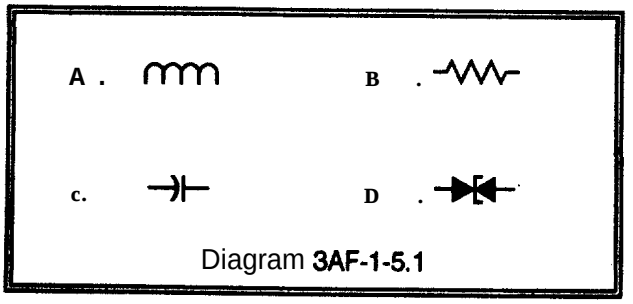


Diagram **3AF-1-5.1**

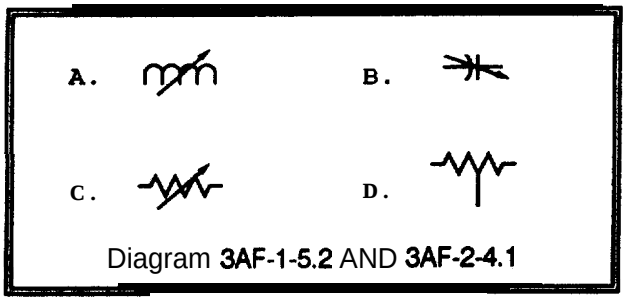


Diagram **3AF-1-5.2** AND **3AF-2-4.1**

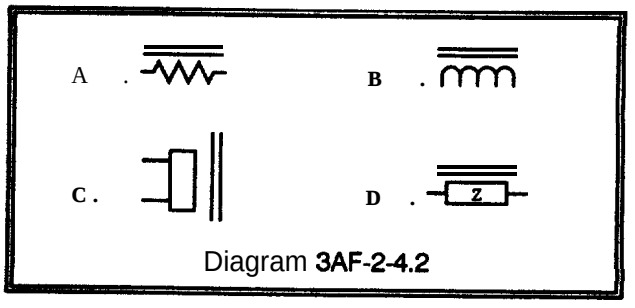


Diagram **3AF-2-4.2**

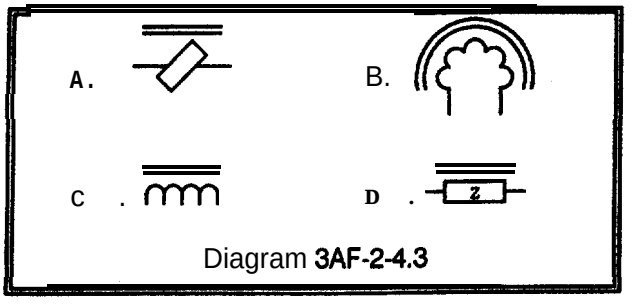


Diagram **3AF-2-4.3**

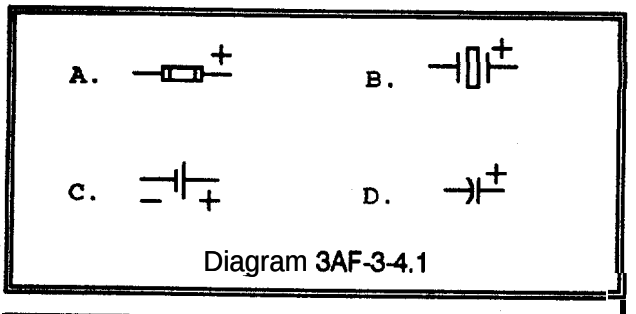
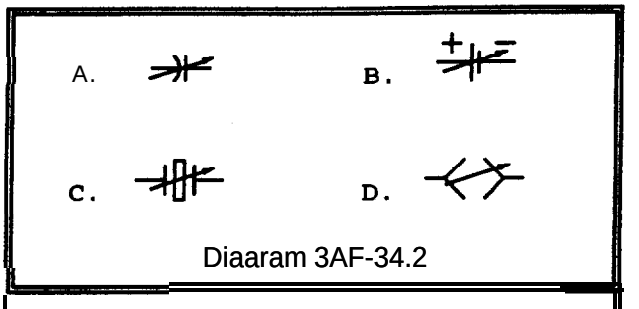


Diagram **3AF-3-4.1**



Diaaram 3AF-34.2

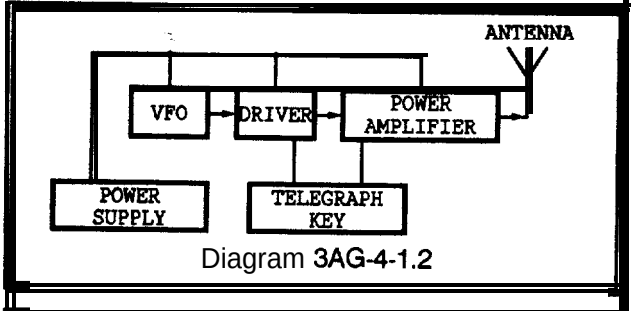


Diagram **3AG-4-1.2**

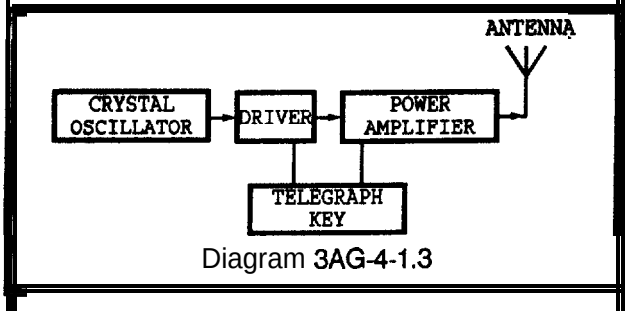
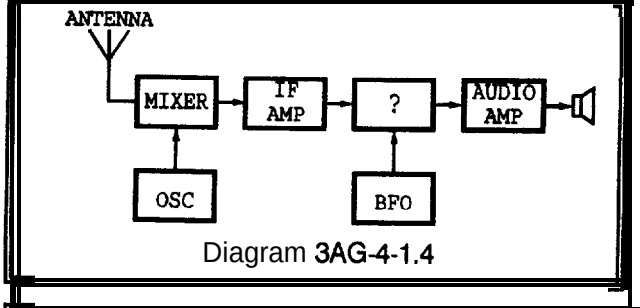


Diagram **3AG-4-1.3**



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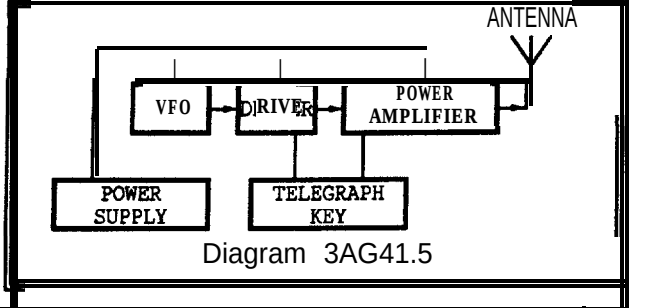


Diagram 3AG41.5

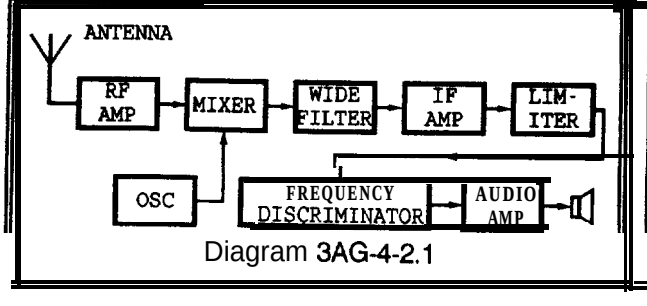
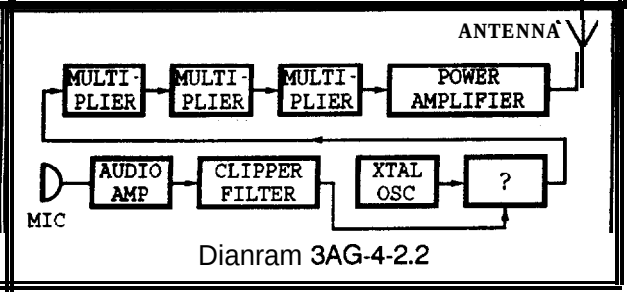


Diagram **3AG-4-2.1**



Dianram **3AG-4-2.2**

1. A [3AA-1.1]
2 B [3AA-1.2]
3. C [3AA-2.2]
4. B [3AA-2.3]
5. A [3AA-2.4]
6. B [3AA-2.5]
7. A [3AA-3.1]
8. A [3AA-3.2]
9. A [3AA-3.3]
10. B [3AA-4.1]
11. A [3AA-4.2]
A [3AA-4.3]
12 D [3AA-5.1]
14. C [3AA-5.2]
15. c [3AA-6-1.1]
16. D [3AA-6-1.2]
17. C [3AA-6-2.1]
18. D [3AA-6-3.1]
19. B [3AA-6-4.1]
20. c [3AA-7-1 .1]
21. B [3AA-7-1.2]
22. D [3AA-7-1.3]
23. C [3AA-7-2.1]
25. C [3AA-7-2.2]
A [3AA-7-3.1]
26. D [3AA-7-3.2]
27. D [3AA-7-3.3]
28. B [3AA-8-1.1]
29. B [3AA-8-2.1]
30. c [3AA-8-3.1]
31. A [3AA-9-1.1]
32. A [3AA-9-2.1]
33. A [3AA-10.1]
34. c [3AA-10.2]
35. D [3AA-10.3]
36. B [3AA-10.4]
37. A [3AA-11-1.1]
38. B [3AA-1 I-I .2]
39. A [3AA-11-1.3]
40. D [3AA-11-2.1]
41. A [3AA-1 1-2.2]
42. C [3AA-11-2.3]
43. A [3AA-1 1-2.4]
44. A [3AA-12.1]
45. C [3AA-12.2]
46. B [3AA-12.3]
47. D [3AA-12.4]
48. c [3AA-12.5]
49. B [3AA-13.1]
50. D [3AA-13.2]
51. D [3AA-13.3]
52. c [3AA-13.4]
53. D [3AA-14.1]
54. C [3AA-14.2]
55. D [3AA-14.3]
56. A [3AA-15.1]
57. C [3AA-15.2]
58. D [3AA-15.3]
59. B [3AA-15.4]
60. B [3AA-16.1]
61. D [3AA-16.2]
62. C [3AA-16.3]
63. A [3AA-17.1]
64. A [3AB-1.1]
65. c [3AB-1.2]
66. D [3AB-1.3]
67. B [3AB-2-1.1]
68. c [3AB-2-1.2]
69. A [3AB-2-1.3]
70. D [3AB-2-1.4]
71. B [3AB-2-1.5]
72. B [3AB-2-1.6]
73. D [3AB-2-1.7]
74. c [3AB-2-2.1]
75. c [3AB-2-2.2]
76. D [3AB-2-3.1]
77. B [3AB-2-3.2]
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79. C [3AB-2-3.4]
80. D [3AB-2-4.1]
81. A [3AB-3.1]
82. B [3AB-3.2]
83. c [3AB-3.3]
84. A [3AB-4.1]
85. D [3AB-4.2]
86. c [3AB-5-1.1]
87. B [3AB-5-1.2]
88. D [3AB-5-2.1]
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91. D [3AB-6-2.1]
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99. B [3AC-1-3.1]
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102. C [3AC-1-4.3]
103. D [3AC-2.1]
104. B [3AC-2.2]
105. A [3AC-2.3]
106. B [3AC-2.4]
107. D [3AC-3.1]
108. C [3AC-3.2]
109. A [3AC-3.3]
110. B [3AC-3.4]
111. D [3AC-4.1]
112. C [3AC-4.2]
113. A [3AC-4.3]
114. C [3AC-5.1]
115. C [3AC-5.2]
116. A [3AC-6.1]
117. B [3AC-6.2]
118. C [3AC-7.1]
119. A [3AC-7.2]
120. D [3AC-7.3]
121. A [3AC-7.4]
122. B [3AC-7.5]
123. D [3AC-7.6]
124. C [3AD-1-1.1]
125. D [3AD-1-1.2]
126. B [3AD-1-1.3]
127. B [3AD-1-1.4]
128. A [3AD-1-2.1]
129. A [3AD-1-2.2]
130. A [3AD-1-2.3]
131. c [3AD-1-3.1]
132. B [3AD-2-1.1]
133. c [3AD-2-2.1]
134. A [3AD-3-1.1]
135. D [3AD-3-2.1]
136. D [3AD-4.1]
137. A [3AD-5-1.1]
138. c [3AD-5-1.2]
139. B [3AD-5-1.3]
140. A [3AD-5-1.4]
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142. C [3AD-5-2.2]
143. A [3AD-6.1]
144. D [3AD-6.2]
145. A [3AD-6.3]
146. c [3AD-7.1]
147. B [3AD-8-1.1]
149. D [3AD-8-1.2]
150. A [3AD-8-2.1]
151. c [3AD-8-2.2]
152. D [3AD-9.1]
153. B [3AD-9.2]
154. C [3AD-9-3]
155. B [3AD-9.4]
156. A [3AD-9.5]
157. A [3AD-9.6]
153. C [3AD-10.1]
159. A [3AD-10.2]
160. B [3AD-11-1.1]
161. A [3AD-11-1.2]
162. D [3AD-11-2.1]
163. B [3AD-11-2.2]
164. B [3AD-11-2.3]
165. D [3AD-11-2.4]
166. B [3AD-11-2.5]
167. C [3AD-11-3.1]
168. D [3AE-1-1.1]
169. A [3AE-1-2.1]
170. D [3AE-1-2.2]
171. B [3AE-1-3.1]
172. D [3AE-1-3.2]
173. B [3AE-1-4.1]
174. C [3AE-1-4.2]
175. D [3AE-2.1]
176. A [3AE-2.2]
177. C [3AE-2.3]
178. D [3AE-2.4]
179. B [3AE-2.5]
180. D [3AE-2.6]
181. D [3AE-2.7]
182. A [3AE-2.8]
183. A [3AE-2.9]
184. C [3AE-3-1.1]
185. C [3AE-3-2.1]
186. C [3AE-3-2.2]

187. B [3AE-3-2.3]
188. C [3AE-3-2.4]
189. B [3AE-3-3.1]
190. c [3AE-3-3.2]
191. A [3AE-3-4.1]
192 B [3AE-3-4.2]
193. A [3AE-4-1.1]
194. A [3AE-4-2.1]
195. B [3AE-4-2.2]
196. A [3AE-4-2.3]
197. B [3AE-4-2.4]
198. C [3AE-4-3.1]
199. B [3AE-4-3.2]
200. A [3AE-4-4.1]
201. A [3AE-4-4.2]
202. B [3AF-1-1.1]
203. D [3AF-1-2.1]
204. c [3AF-1-2.2]
205. A [3AF-1-3.1]
206. B [3AF-1-3.2]
207. B [3AF-1-3.3]
208. C [3AF-1-3.4]
209. A [3AF-1-4.1]
210. C [3AF-1-4.2]
211. B [3AF-1-5.1]
212 C [3AF-1-5.2]
213. D [3AF-2-1.1]
214. A [3AF-2-1.2]
215. D [3AF-2-1.3]
216. C [3AF-2-1.4]
217. D [3AF-2-2.1]
218. C [3AF-2-2.2]
219. D [3AF-2-3.1]
220. B [3AF-2-3.2]
221. A [3AF-2-3.3]
222. B [3AF-2-3.4]
223. A [3AF-2-4.1]
224. B [3AF-2-4.2]
225. C [3AF-2-4.3]
226. D [3AF-3-1.1]
227. A [3AF-3-1.2]
228. C [3AF-3-1.3]
229. C [3AF-3-1.4]
230. B [3AF-3-2.1]
231. D [3AF-3-2.2]
232. A [3AF-3-2.3]
233. B [3AF-3-2.4]
234. A [3AF-3-3.1]
235. B [3AF-3-3.2]
236. D [3AF-3-3.3]
237. D [3AF-3-4.1]
238. A [3AF-3-4.2]
239. A [3AG-1-1.1]
240. D [3AG-1-1.2]
241. C [3AG-1-2.1]
242. B [3AG-1-2.2]
243. B [3AG-2-1.1]
244. A [3AG-2-2.1]
245. B [3AG-2-2.2]
246. A [3AG-3-1.1]
247. D [3AG-3-1.2]
248. A [3AG-3-2.1]
249. c [3AG-4-1.1]
250. D [3AG-4-1.2]
251. B [3AG-4-1.3]
252. B [3AG-4-1.4]
253. D [3AG-4-1.5]
254. D [3AG-4-2.1]
255. c [3AG-4-2.2]
256. A [3AH-1.1]
257. A [3AH-2-1.1]
258. B [3AH-2-1.2]
259. C [3AH-2-2.1]
260. A [3AH-2-2.2]
261. B [3AH-2-3.1]
262. A [3AH-2-3.2]
263. B [3AH-2-4.1]
264. D [3AH-2-4.2]
265. A [3AH-2-5.1]
266. D [3AH-2-5.2]
267. C [3AH-2-5.3]
268. A [3AH-2-6.1]
269. B [3AH-2-6.2]
270. D [3AH-2-7.1]
271. B [3AH-2-7.2]
272. C [3AH-2-8.1]
273. D [3AH-2-8.2]
274. A [3AH-3.1]
275.' B [3AH-3.2]
276. C [3AH-4.1]
277. D [3AH-5.1]
278. C [3AH-5.2]
279. D [3AH-6.1]
280. C [3AH-6.2]
281. D [3AH-7-1.1]
282. B [3AH-7-2.1]
283. C [3AH-7-2.2]
284. A [3AI-1-1.1]
285. D [3AI-1-1.2]
286. C [3AI-1-1.3]
287. A [3AI-1-1.4]
288. C [3AI-1-1.5]
289. B [3AI-1-1.6]
290. A [3AI-1-1.7]
291. B [3AI-1-2.1]
292. B [3AI-1-2.2]
293. D [3AI-1-2.3]
294. C [3AI-1-2.4]
295. A [3AI-1-3.1]
296. B [3AI-2-1.1]
297. C [3AI-2-1.2]
298. C [3AI-2-1.3]
299. D [3AI-2-2.1]
300. D [3AI-2-2.2]
301. C [3AI-2-2.3]
302. D [3AI-2-2.4]
303. D [3AI-2-2.5]
304. D [3AI-3-1.1]
305. A [3AI-3-1.2]
306. A [3AI-3-2.1]
307. B [3AI-3-2.2]
308. D [3AI-3-3.1]
309. C [3AI-3-3.2]
310. C [3AI-3-3.3]
311. D [3AI-4-1.1]
312. C [3AI-4-1.2]
313. B [3AI-4-2.1]
314. A [3AI-4-2.2]
315. A [3AI-4-3.1]
316. B [3AI-4-3.2]
317. C [3AI-5-1.1]
318. A [3AI-5-1.2]
319. C [3AI-5-2.1]
320. B [3AI-5-2.2]
321. B [3AI-5-3.1]
322. A [3AI-5-3.2]
323. B [3AI-5-3.3]
324. D [3AI-6-1.1]
325. C [3AI-6-2.1]